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**13. ABSTRACT** *(Maximum 200 words)*

THE OBJECTIVES OF THIS RESEARCH ARE TO CONDUCT LABORATORY EXPERIMENTS THAT WILL PREDICT THE PHOTOCHEMICAL AND BIOLOGICAL TRANSFORMATIONS OF DCPD AND DIMP IN THE SOILS AND WATERS OF ROCKY MOUNTAIN ARSENAL AND WILL PROVIDE A SEMIQUANTITATIVE EVALUATION OF DECOMPOSITION RATES OF AND PRODUCTS RESULTING FROM DCPD AND DIMP. DURING JULY, THIS PROJECT WAS INITIATED AND PRELIMINARY INVESTIGATIONS IN ANALYTICAL CHEMISTRY, MICROBIOLOGY, AND PHOTOCHEMISTRY WERE PERFORMED. ARRANGEMENTS HAVE BEEN MADE TO COLLECT FIELD SAMPLES AT ROCKY MOUNTAIN ARSENAL IN AUGUST. THIS WILL ENABLE US TO INITIATE THE STUDIES TO OBTAIN ACCLIMATED CULTURES FOR THE BIODEGRADATION PHASE OF THIS PROJECT. ANALYTICAL WORK ON DCPD WILL CONTINUE, AND THE PHOTOCHEMICAL STUDIES WILL BE INITIATED. EXHIBIT A IS A PRELIMINARY PERFORMANCE SCHEDULE FOR THIS PROJECT. EXHIBIT B DEPICTS THE EXPENDITURE OF FUNDS.



**14. SUBJECT TERMS**
CONTAMINANTS, FAUNA, FLORA, SOIL, GROUNDWATER, BIODEGRADATION, CHEMICALS

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# STUDIES OF ENVIRONMENTAL FATES OF DIMP AND DCPD

Monthly Progress Report 1

4 August 1978

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## Introduction

The U.S. Army Medical Bioengineering Research and Development Laboratory has the responsibility of developing environmental standards for pollutants that contaminate the environment at Army installations. Two such pollutants at the Rocky Mountain Arsenal are dicyclopentadiene (DCPD) and diisopropylmethylphosphonate (DIMP).

The objectives of this research are to conduct laboratory experiments that will predict the photochemical and biological transformations of DCPD and DIMP in the soils and waters of Rocky Mountain Arsenal and will provide a semiquantitative evaluation of decomposition rates of and products resulting from DCPD and DIMP.

## Progress

During July, this project was initiated and preliminary investigations in analytical chemistry, microbiology, and photochemistry were performed.

### Analytical Chemistry

Arrangements were made with the project officer to have samples of DIMP, isopropylmethylphosphonate, and methylphosphonic acid shipped to SRI.

DCPD, obtained from Columbia Organic Chemicals (purity 99%), was found to be 96% pure by gas chromatographic analysis. Analysis of the impurities by gc/ms showed that they were mainly oxygenated derivatives of DCPD (see Figure 1 and attachments). These derivatives may be expected in photochemical or microbial transformation studies.

### Biodegradation

A preliminary test for toxic effects of DCPD was conducted with microorganisms collected from a eutrophic pond in Woodside, California, and from SRI soil. Mixed cultures of microorganisms were grown for 24 hr in shaker flasks containing basal salts medium with glucose and yeast extract at 25° C. These organisms were used to inoculate media containing 10 and 50 ppm DCPD. Microbial growth was measured by the turbidity of the broths. Table 1 presents the average turbidities of duplicate flasks after 16 and 40 hours of growth compared with control flasks. These data indicate that DCPD does not inhibit the growth of these organisms at up to 50-ppm concentration levels.

Table 1

EFFECT OF DCPD ON CELL GROWTH

| Microorganism Source | DCPD Concentration (ppm) | Turbidity (% of Control) at 16 hr | Turbidity (% of Control) at 40 hr |
|---|---|---|---|
| Eutrophic pond water | | | |
| | 0 (control) | 100 | 100 |
| | 2 | 99 | 100 |
| | 10 | 100 | 101 |
| | 50 | 99 | 102 |
| SRI soil | | | |
| | 0 | 100 | 100 |
| | 2 | 99 | 99 |
| | 10 | 100 | 99 |
| | 50 | 97 | 102 |

Photochemistry

A preliminary analysis of the uv spectrum of DCPD has shown that the extinction coefficients above 230 nm are less than 83 molar$^{-1}$ cm$^{-1}$. More spectra will be measured for accurate determination of the extinction coefficients (or lower limits), especially in the solar spectrum region above 290 nm.

Future Work

Arrangements have been made to collect field samples at Rocky Mountain Arsenal in August. This will enable us to initiate the studies to obtain acclimated cultures for the biodegradation phase of this project.

Analytical work on DCPD will continue, and the photochemical studies will be initiated.

Exhibit A is a preliminary performance schedule for this project. Exhibit B depicts the expenditure of funds.

EXHIBIT A PERFORMANCE SCHEDULE FOR PROJECT TASKS

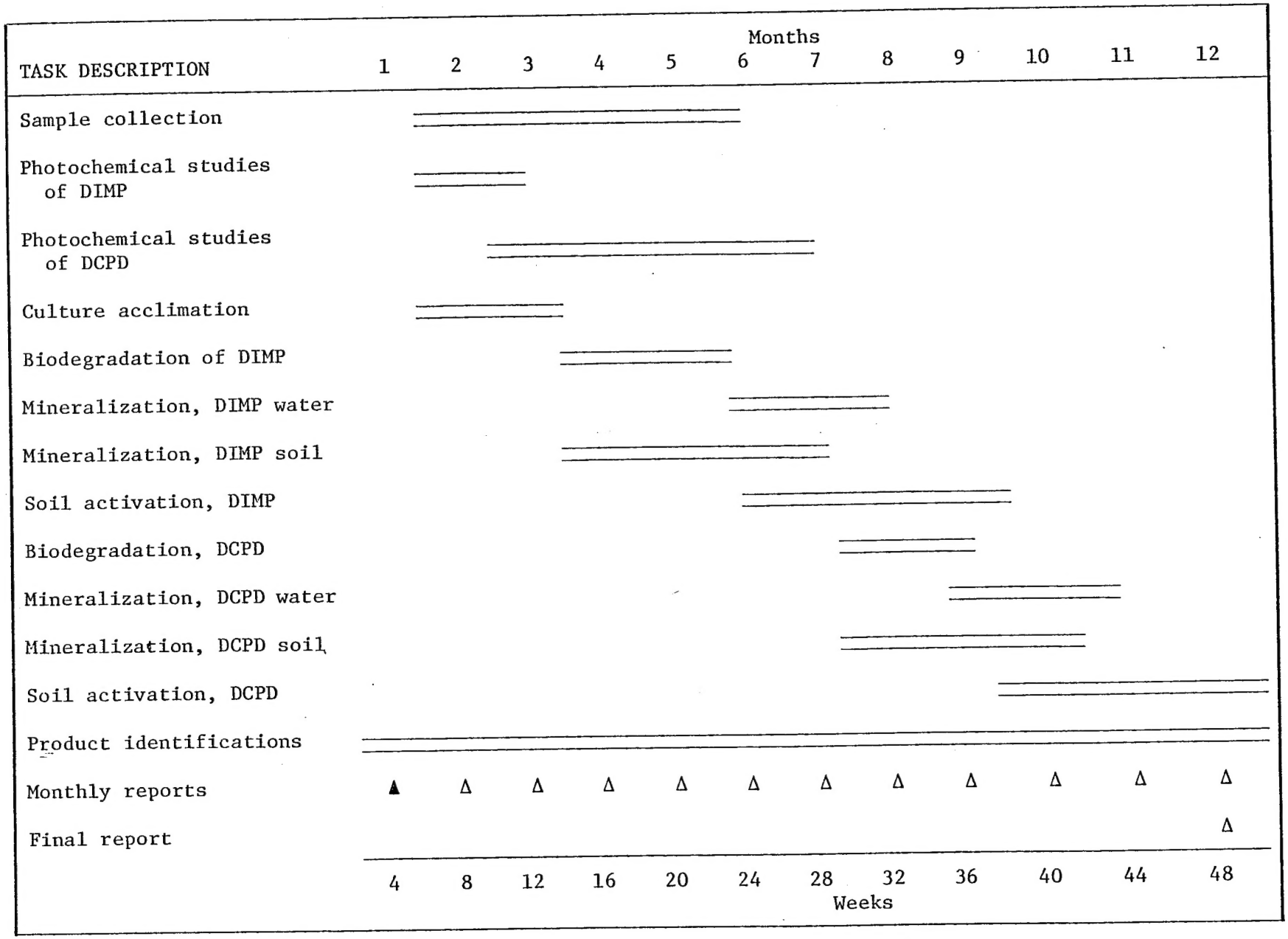
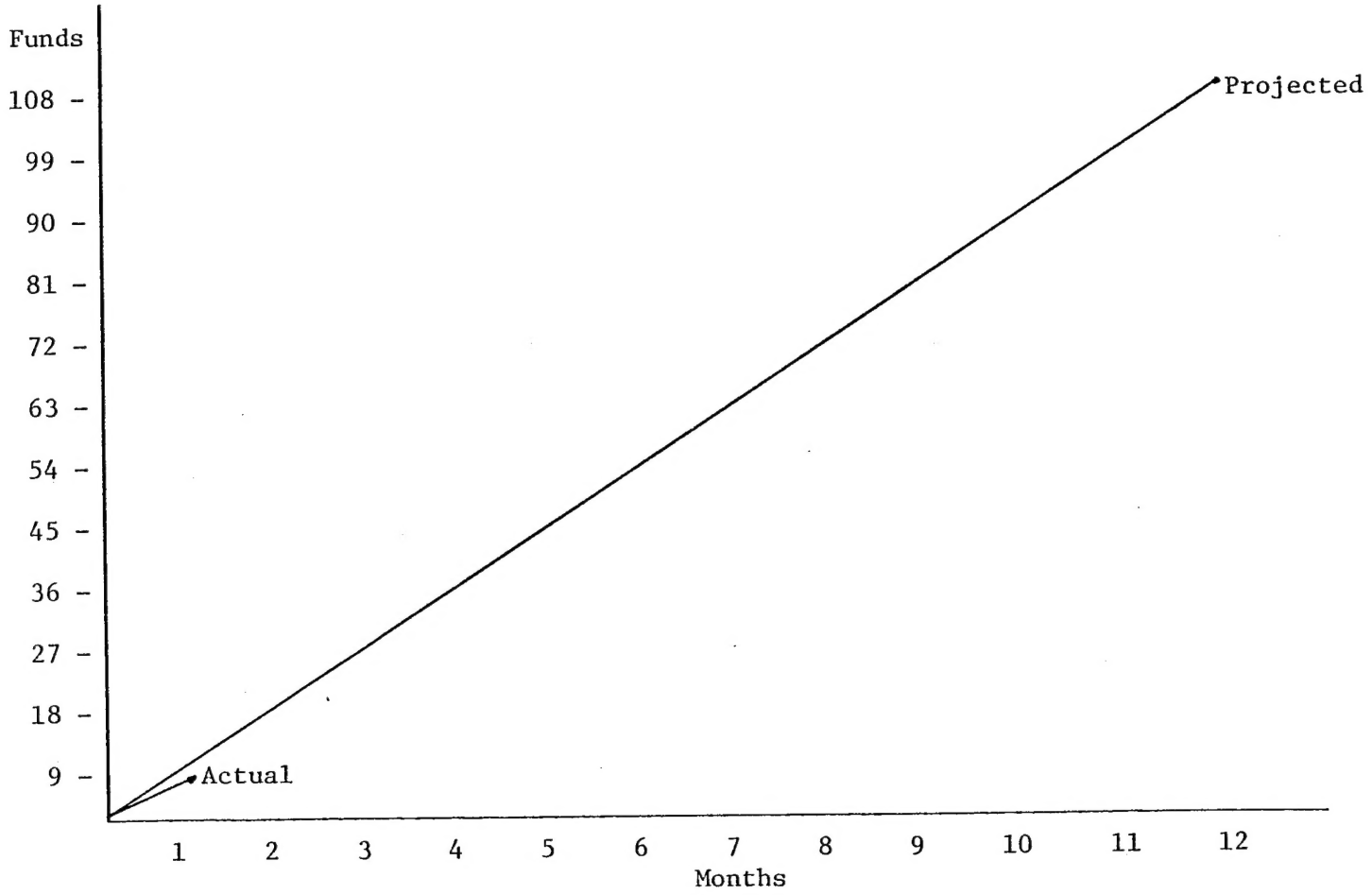


EXHIBIT B EXPENDITURES



# GAS CHROMATOGRAM

No. _____ Date _____ Sign. _____

Vol. Inj. _____ Conc. _____ Solvent _____

Sample _____

Temp. Fl. Heater °C _____ Mol. Sep. °C _____

Col. Isot. °C _____ He. Flow ml/min _____
Program.

Recorder Speed _____ Gain _____

Note _____

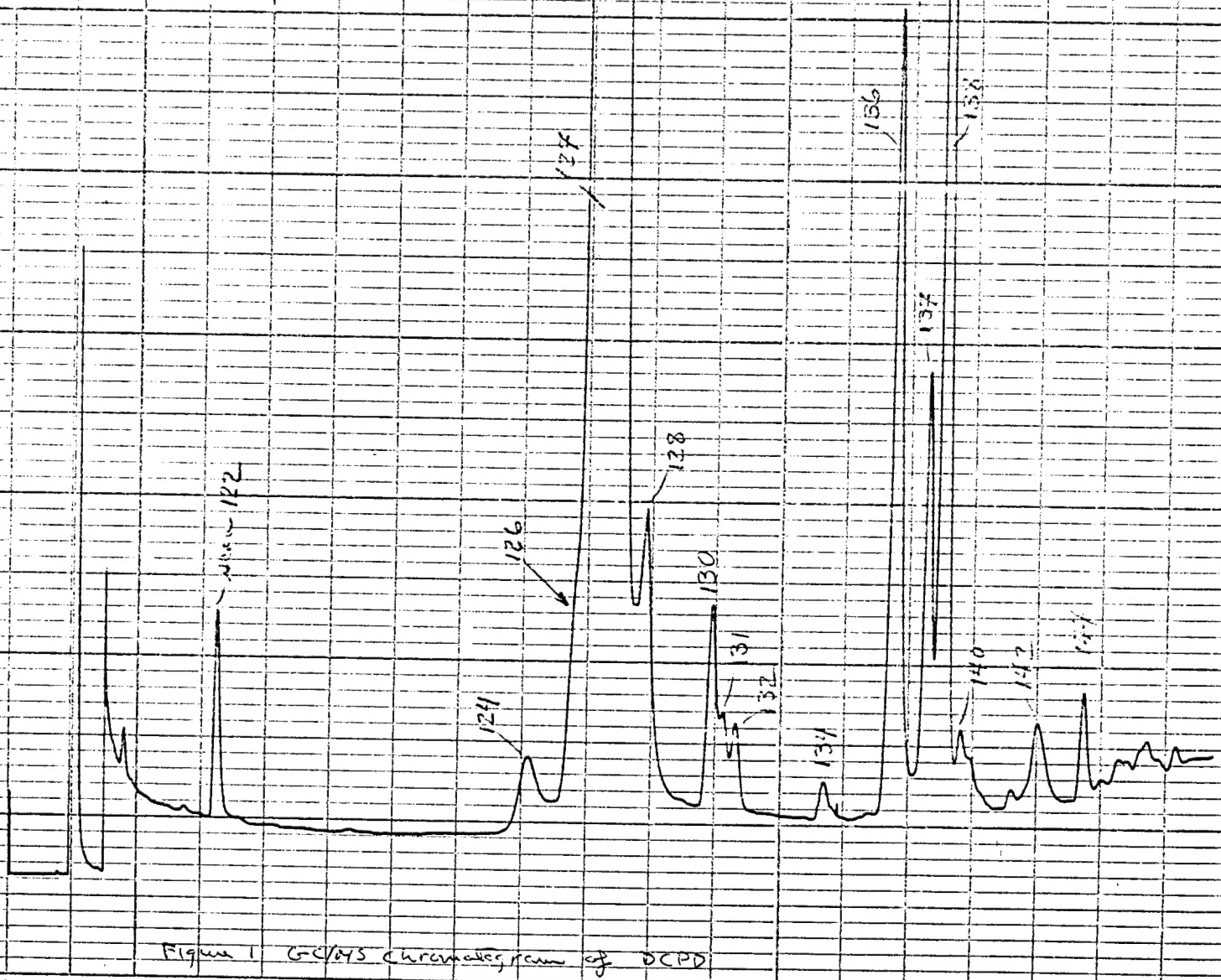
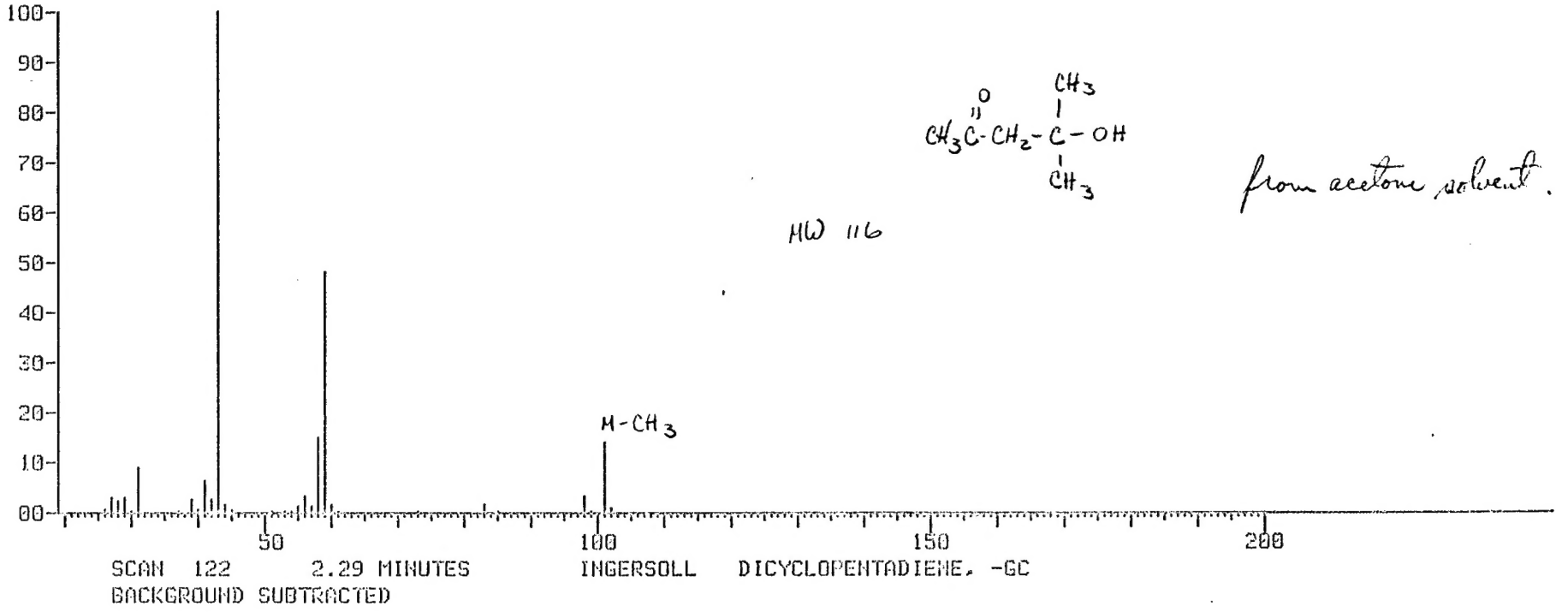



Figure 1 GC/MS chromatogram of DCPD

CHART 15

PERKIN-ELMER

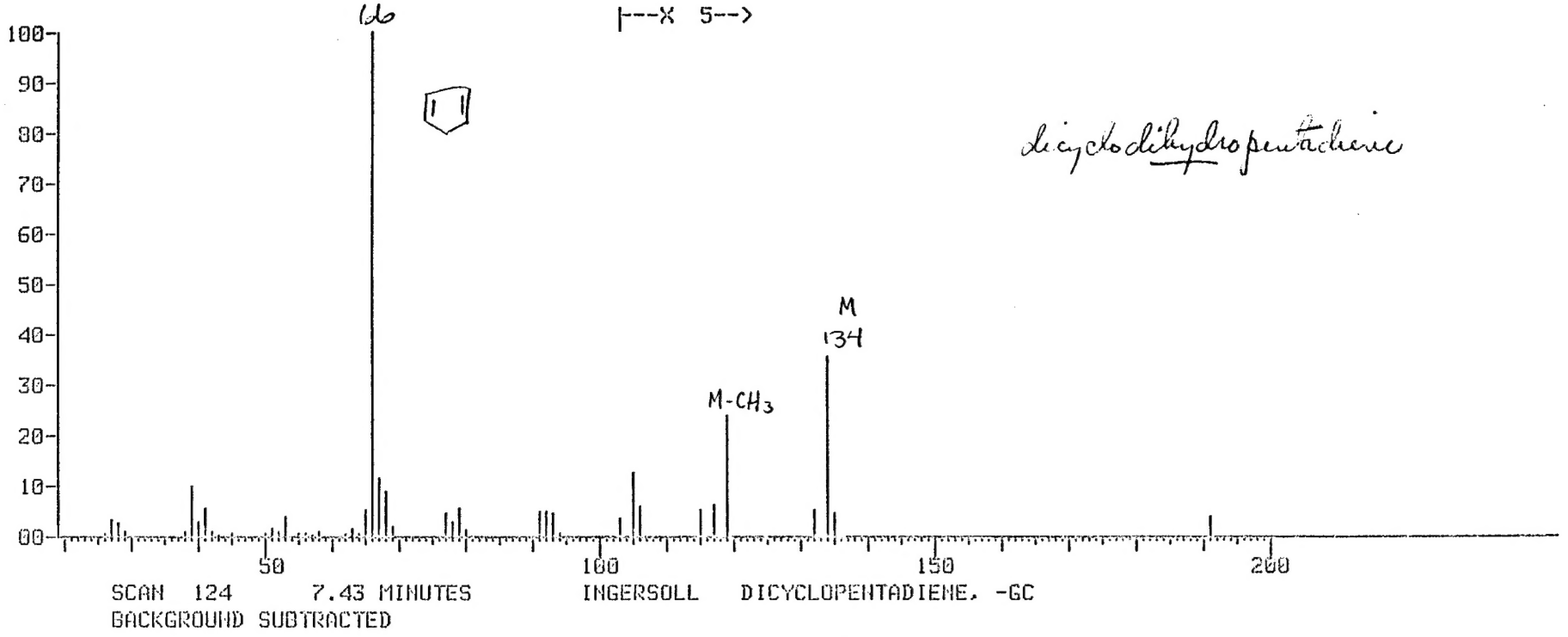



SCAN 122 2.29 MINUTES INGERSOLL DICYCLOPENTADIENE. -GC
BACKGROUND SUBTRACTED



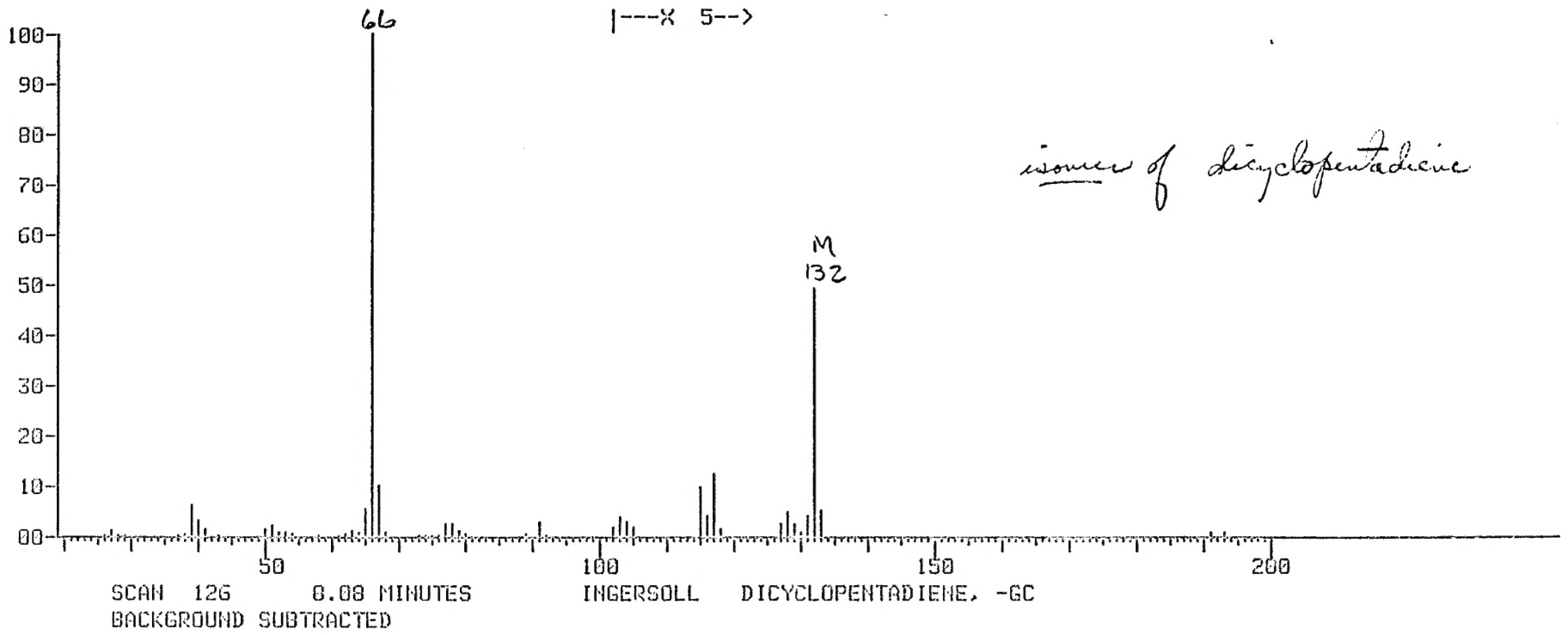

MW 116

from acetone solvent.

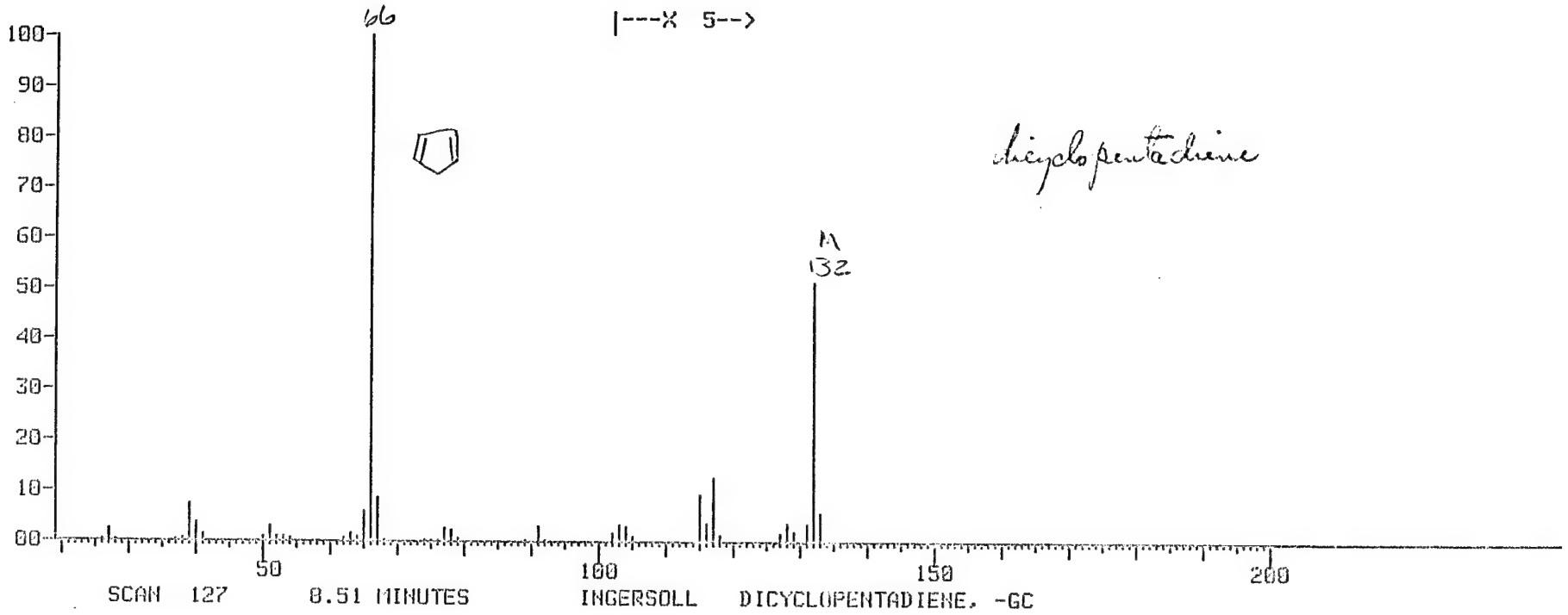



dicyclodihydropentadiene

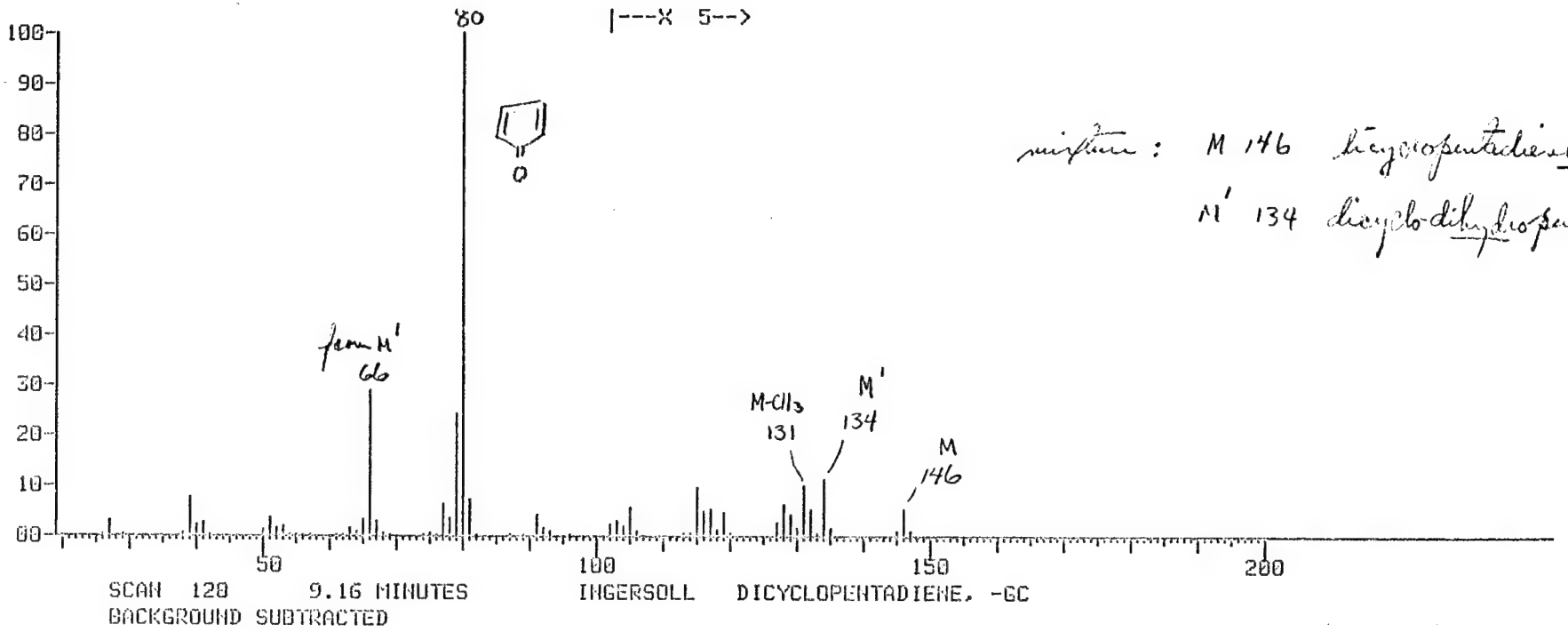
7




isomer of dicyclopentadiene

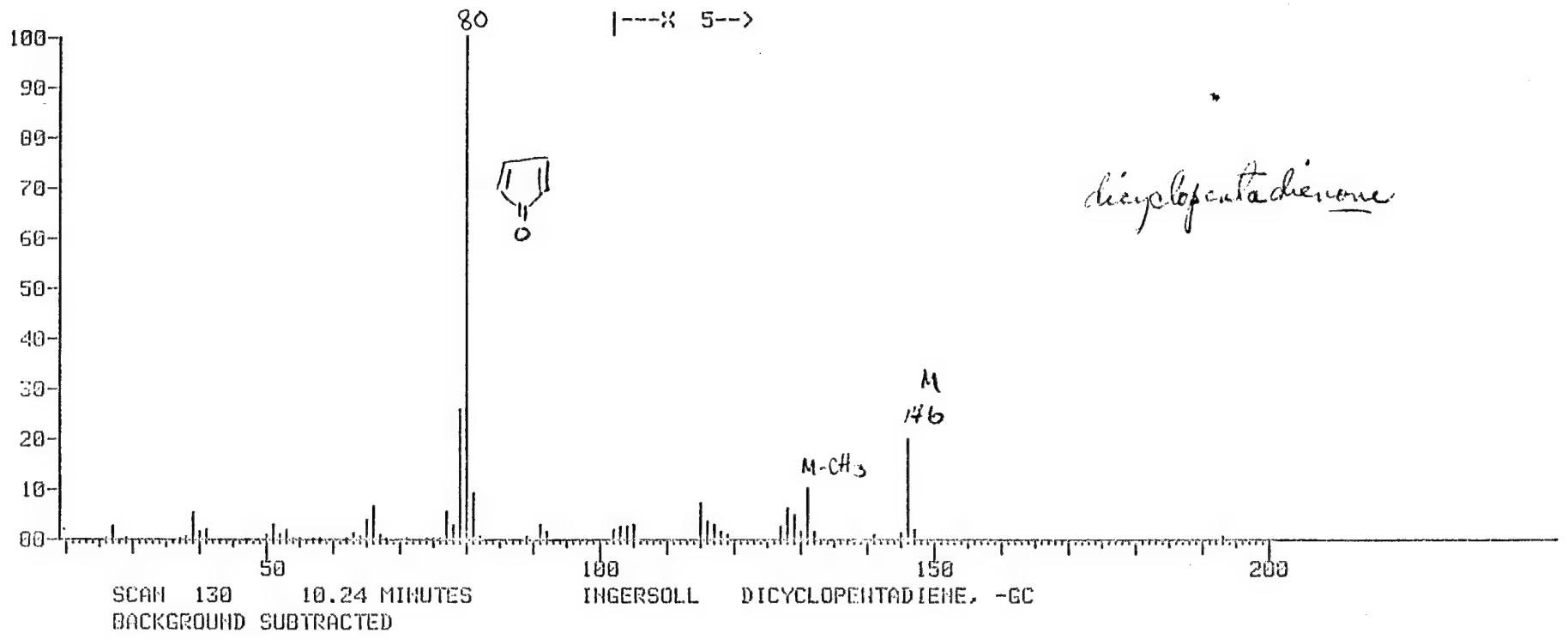



dicyclopentadiene

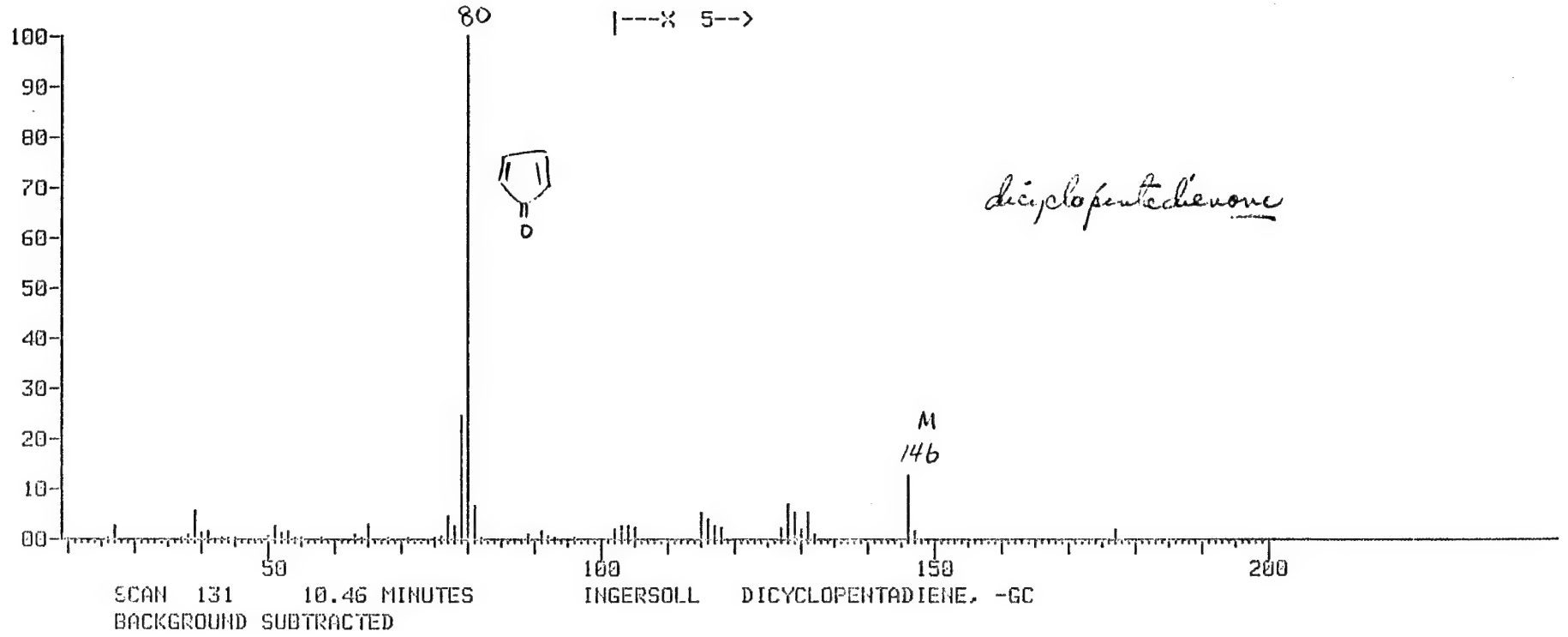



mixture : M 146 bicyclopentadienone (major)

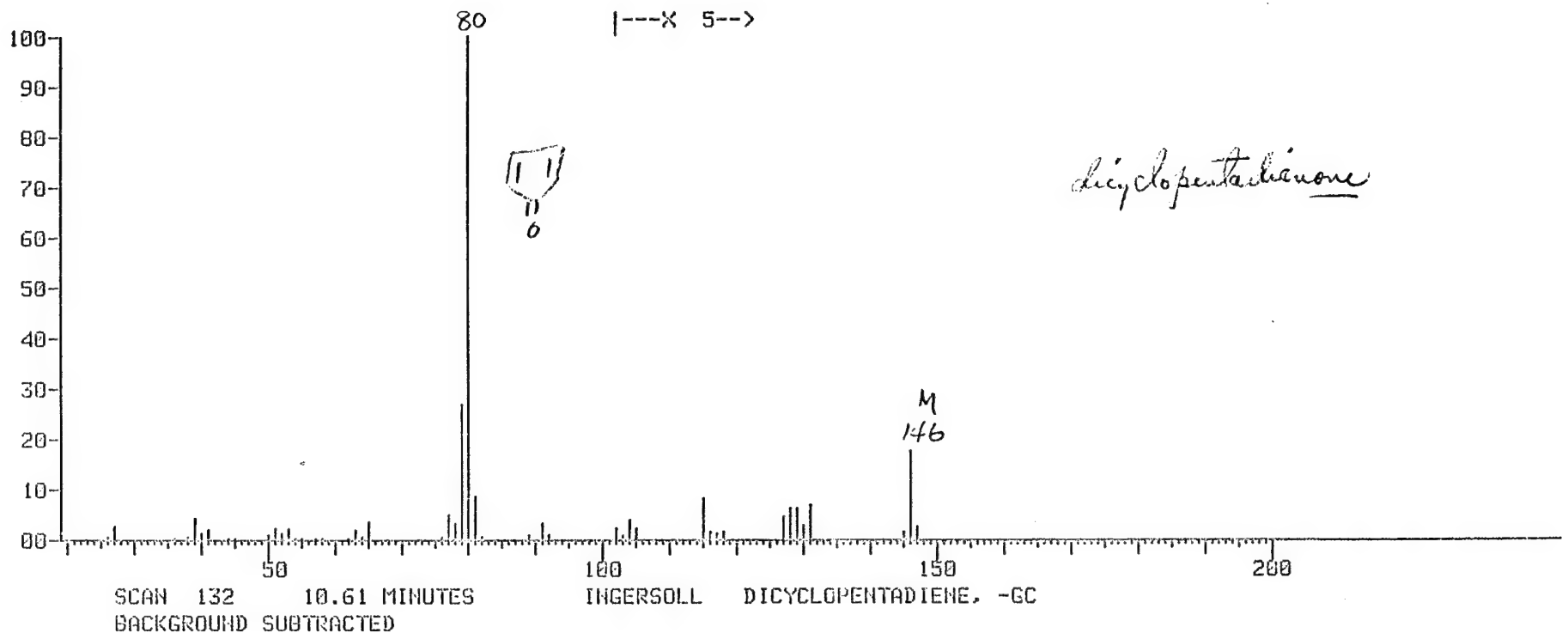
M' 134 bicyclo-dihydropentadiene (minor)



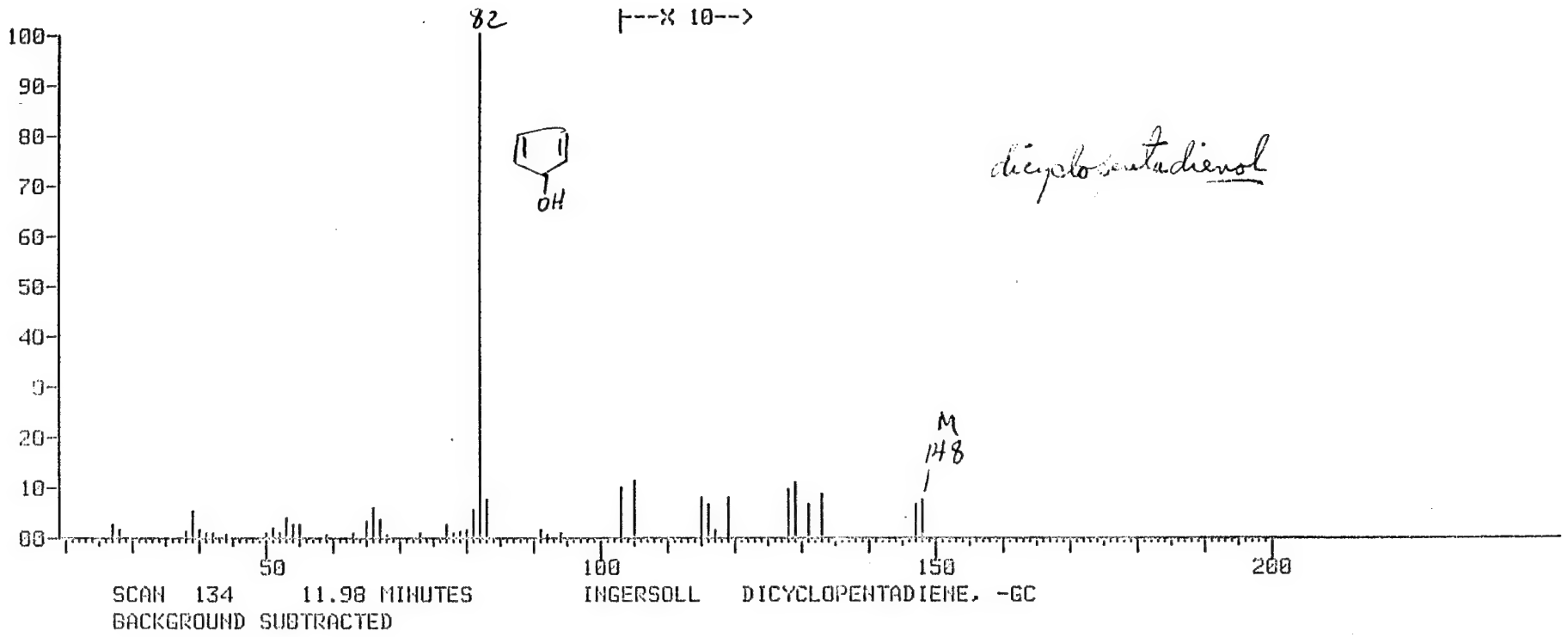

dicyclopentadiene

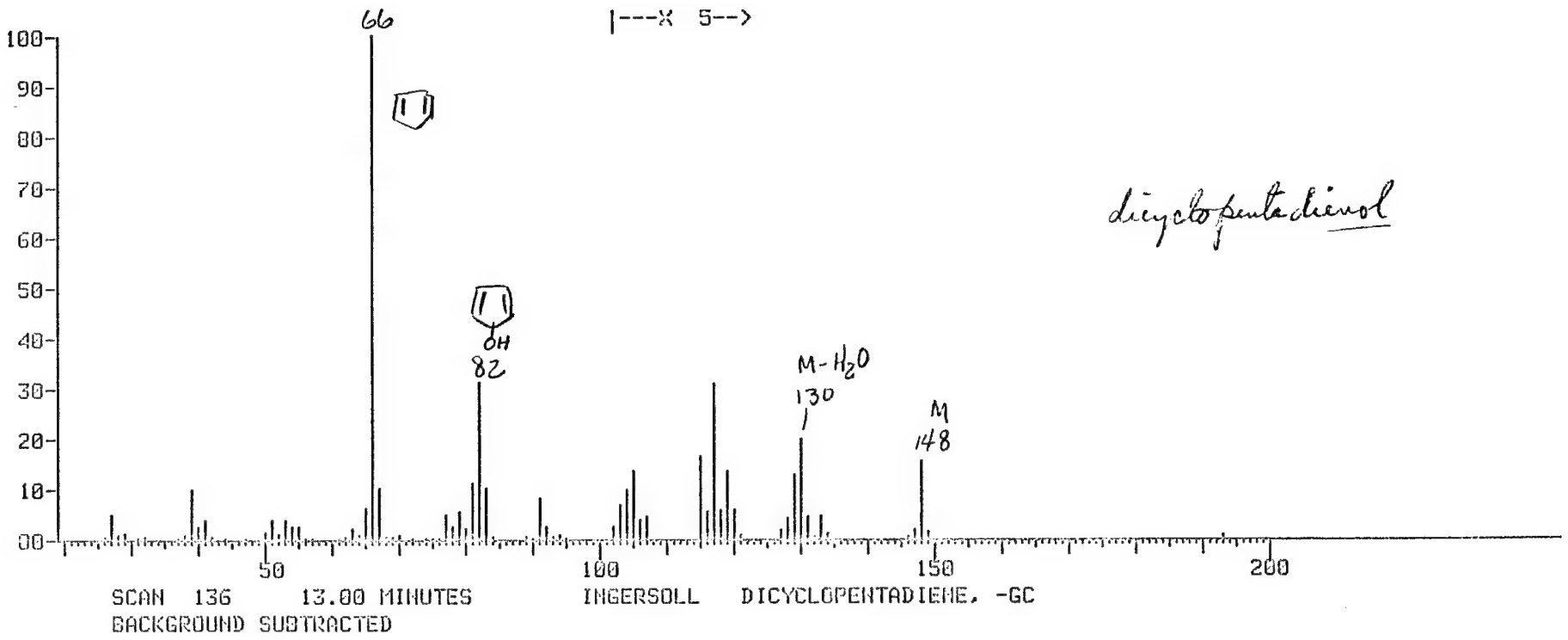



diciclopentadienone

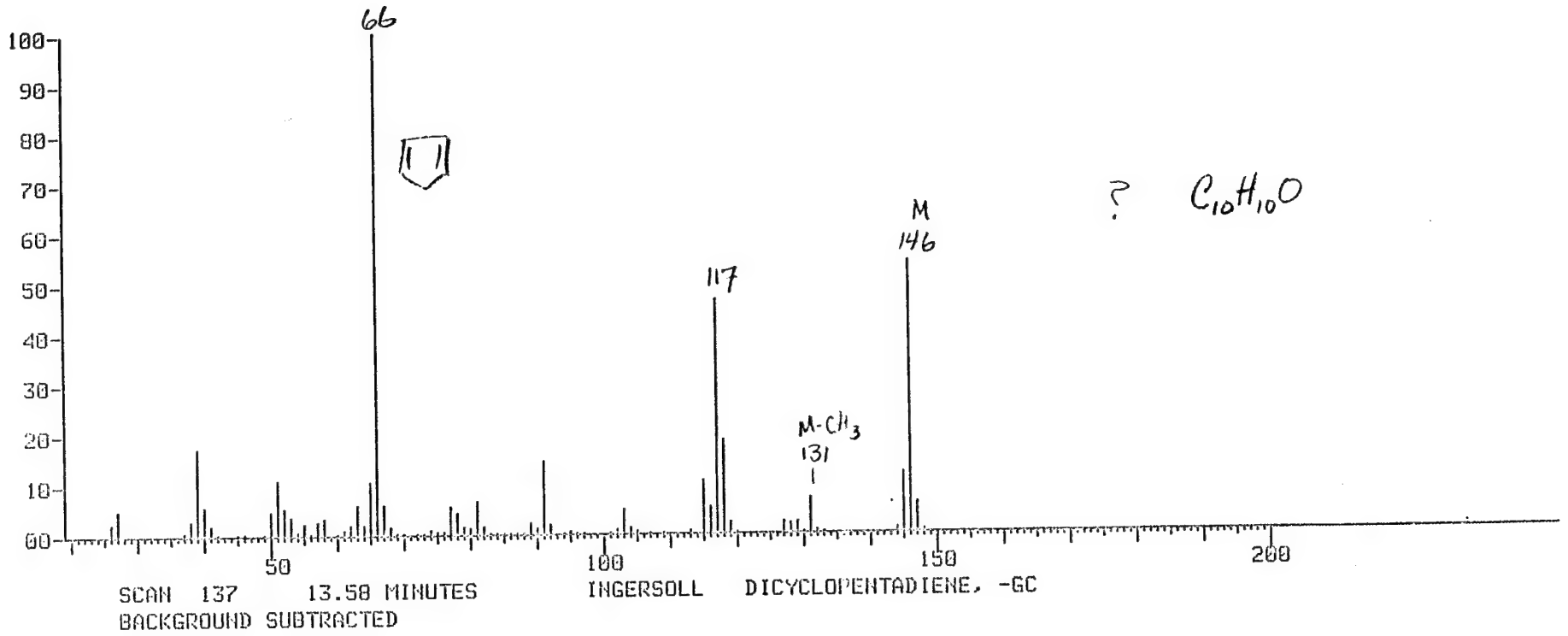



SCAN 132 10.61 MINUTES INGERSOLL DICYCLOPENTADIENE, -GC
BACKGROUND SUBTRACTED

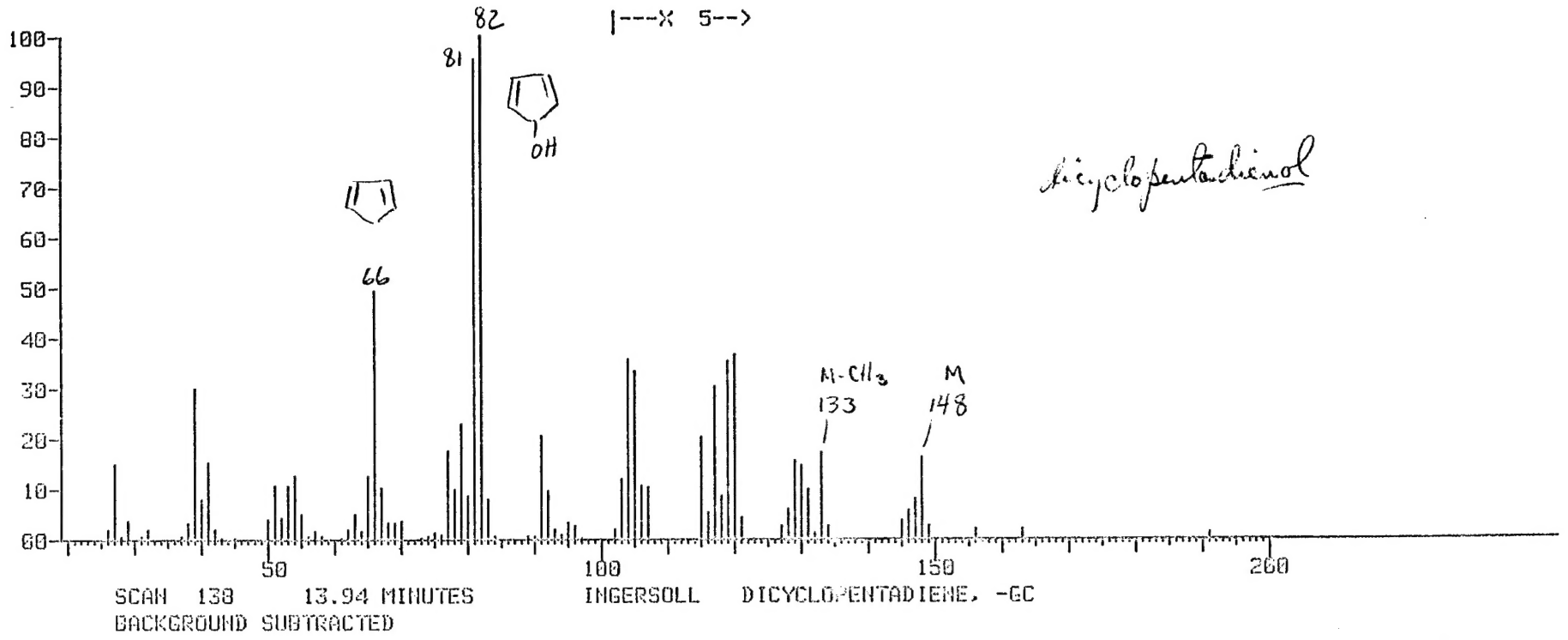

82
|--X 10-->
100
90
80
70
60
50
40
30
20
10
00
OH
dicyclopentadienol
M
148
50
100
150
200
SCAN 134 11.98 MINUTES
INGERSOLL DICYCLOPENTADIENE. -GC
BACKGROUND SUBTRACTED



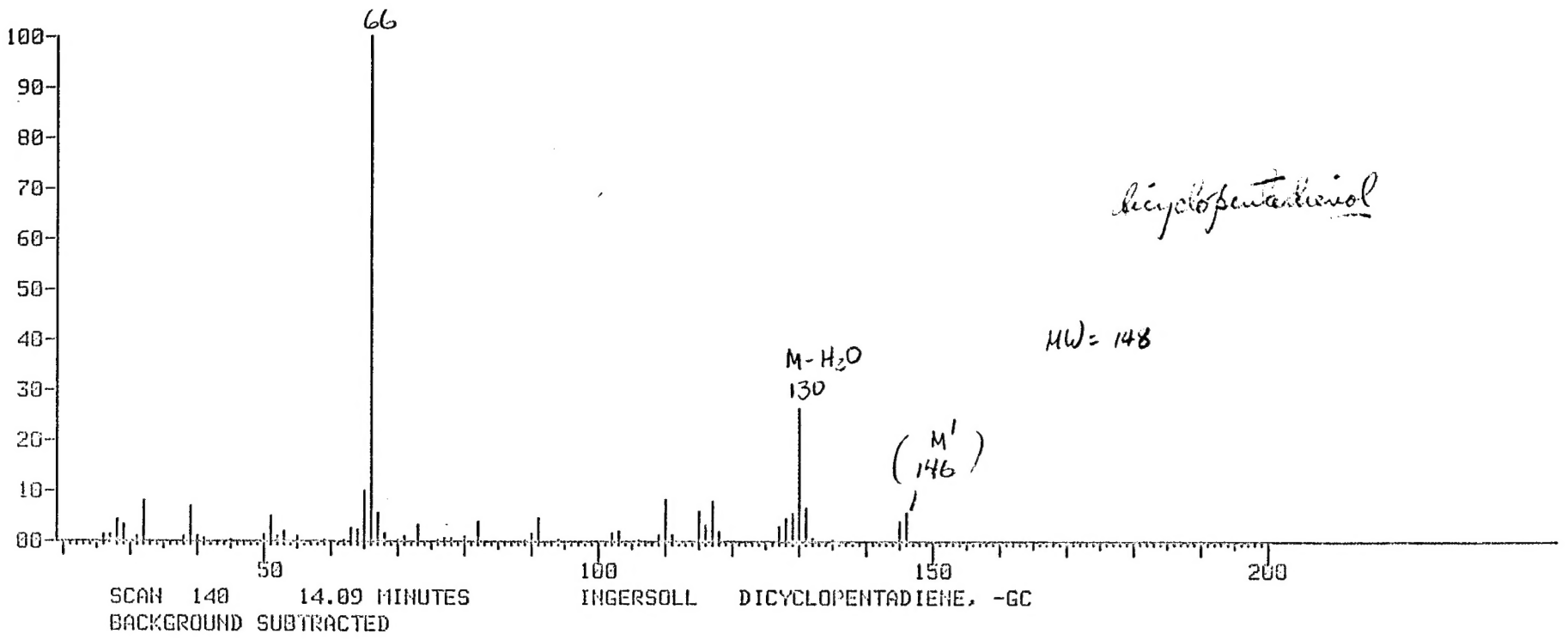

dicyclopentadienol


66
117
M
146
M-CH3
131
100
90
80
70
60
50
40
30
20
10
00
50
100
150
200
SCAN 137 13.58 MINUTES
INGERSOLL DICYCLOPENTADIENE, -GC
BACKGROUND SUBTRACTED

? $C_{10}H_{10}O$

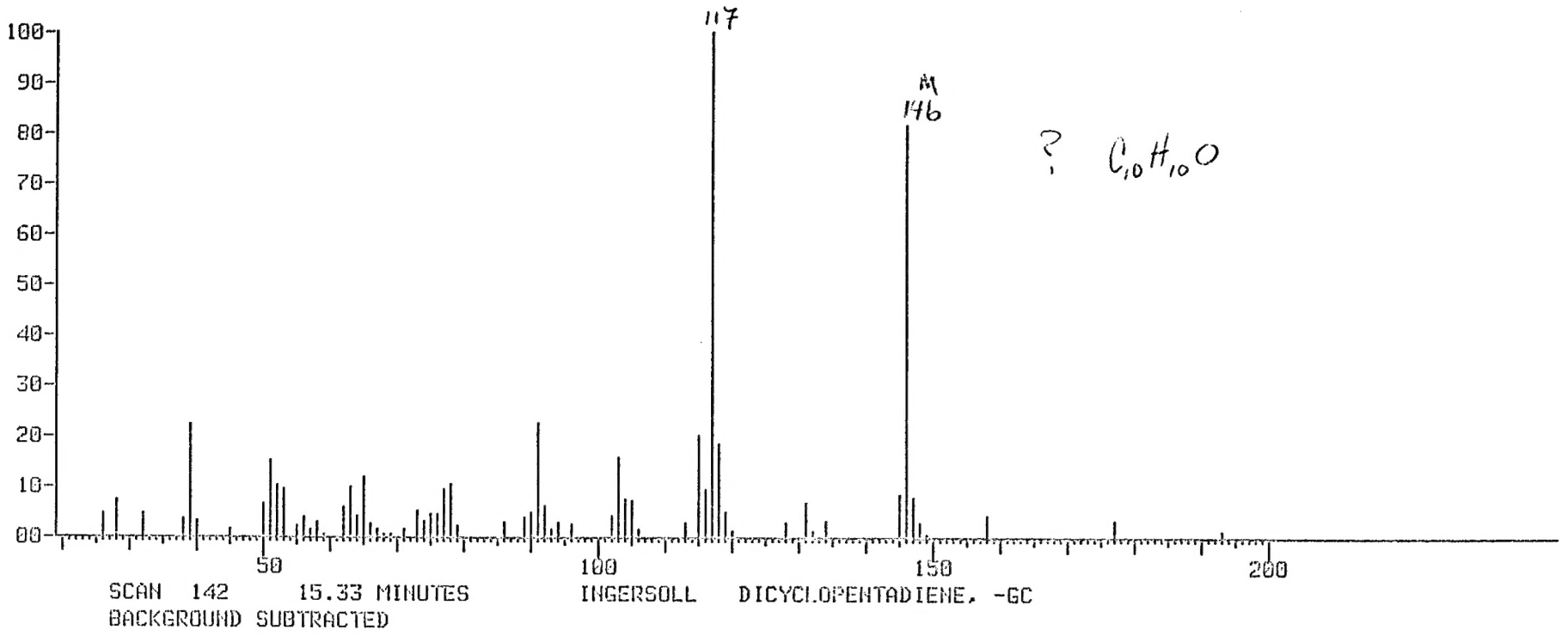



dicyclopentadienol




Dicyclopentadienol

MW = 148


117
M
146
? $C_{10}H_{10}O$
100
90
80
70
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20
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00
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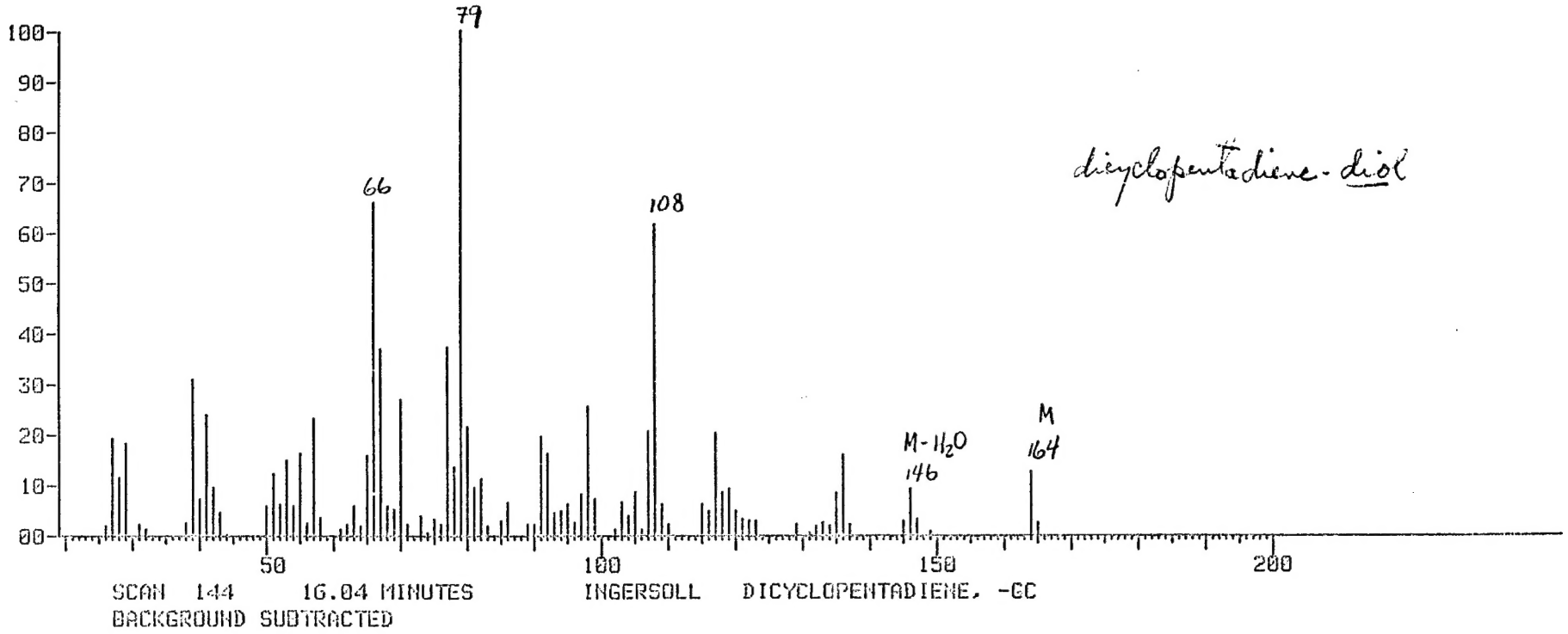
150
200
SCAN 142 15.33 MINUTES INGERSOLL DICYCLOPENTADIENE, -GC
BACKGROUND SUBTRACTED




dicyclopentadiene-diol